



Benjamin L. Augenbraun, Ph.D.
Assistant Professor of Chemistry
Williams College

**Laser Spectroscopy of Metal-Containing
Molecules: Applications Spanning Quantum
Control to Organic Catalysis**

ABSTRACT:

Achieving full control over the quantum mechanical degrees of freedom in molecules has been a long-standing goal in physical chemistry and molecular physics. Potential applications spanning quantum information science, fundamental understanding of reactivity, and precision measurements of symmetry violations have spurred recent efforts to use lasers to cool molecules to ultralow temperatures and control their internal states. In recent years, increasing attention has been attracted by molecules that offer new resources to the areas of quantum science and precision measurements, such as large dipole moments or ground-state parity doublets. In this talk, we will first review recent work demonstrating laser cooling of increasingly complex molecules, and then discuss a class of diatomic molecules that we have identified as potentially laser coolable: coinage metals bonded to carbon-group atoms. We will describe theoretical and experimental efforts focused on molecules such as CuX , AgX , and AuX ($X=\text{C}$, Si , Ge , Sn , and Pb). Interestingly, this spectroscopic work is also relevant to fundamental understanding of organic catalysis, due to the synthetic utility of copper and gold in activating C-C double or triple bonds. We are thus also preparing to perform spectroscopy of AuCC and AuCCH to study model systems for gold-alkyne interactions.

BIO:

Benjamin Augenbraun received his BA in physics from Williams College in 2015 and his PhD in physics from Harvard University 2022. As an undergraduate, he worked with Prof. Tiku Majumder on high-precision laser spectroscopy of atomic structure in order to benchmark ab initio theories.